# Clarks Creek-

Monitoring Station- SC517
USGS Gaging Station- 06879200, 10/1/1957-9/30/1965
Included area-
HUC 8: 10270101
HUC 10: 01
HUC 12: 01, 02, 03, 04, 05, 06
Streams Flowing to Monitoring Station-

| Name | Segment # |
|---|---|
| Clarks Creek- | 8 |
| Clarks Creek- | 9 |
| Humbolt Creek- | 10 |
| Davis Creek- | 18 |
| Dry Creek- | 19 |
| Mulberry Creek- | 20 |
| Ralls Creek- | 21 |

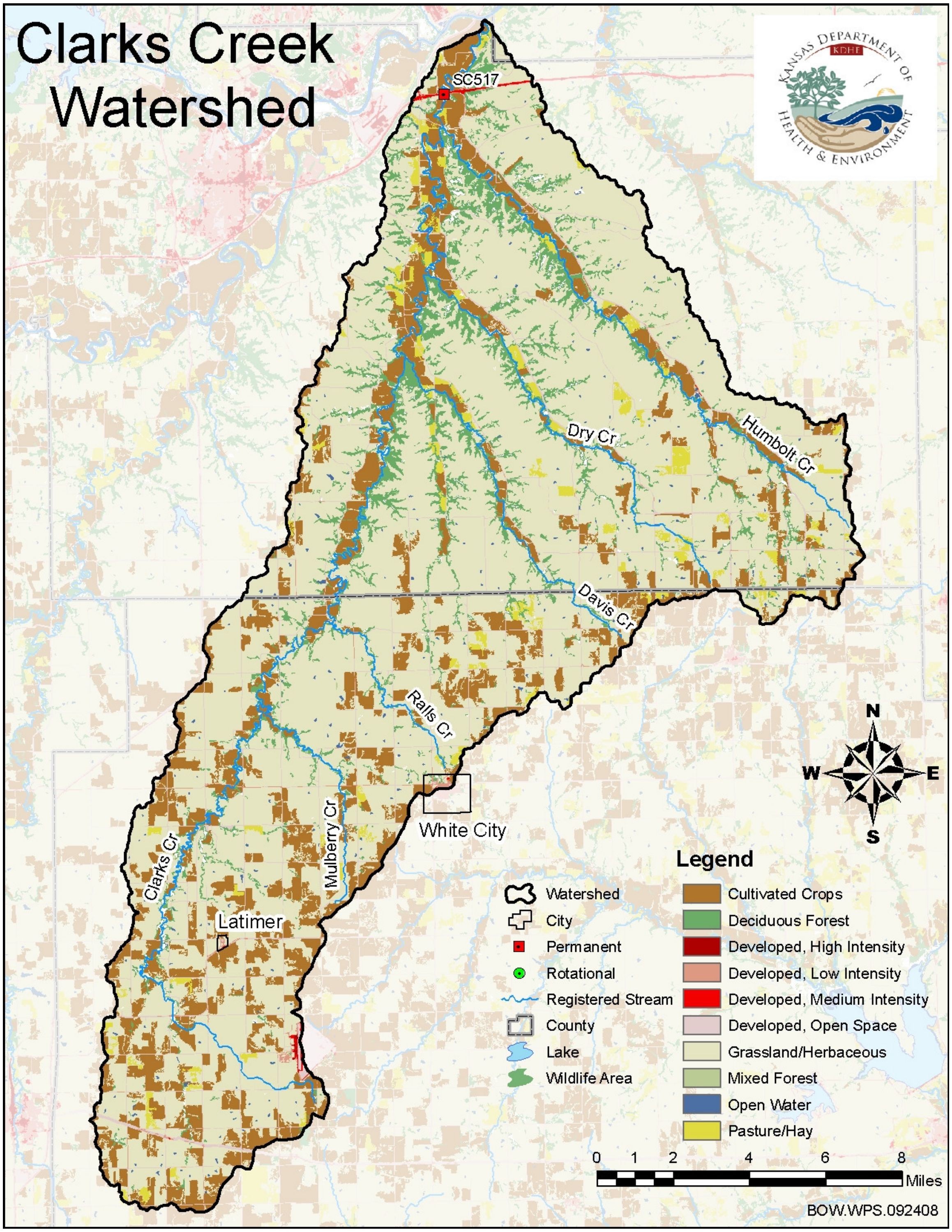
Land use-

| | |
|---|---|
| Permanent Grass | 68.76% |
| Cropland | 17.51% |
| Forest | 9.60% |
| Developed Land | 3.68% |

Counties- Geary, Morris
Cities- Latimer, White City
Humboldt Creek Watershed District- Includes only the portion of the watershed draining directly to Humboldt Creek (HUC12-102701010105)
2000 Population- 1,439
Kansas House Districts-65 & 68
Kansas Senate Districts- 17 & 22
Monitored Watershed Size- 247 square miles

2008 303(d) impaired waters- None
TMDLs- Bacteria, approved 1/26/2000
NPDES Permitted Facilities- None
Permitted Confined Animal Feeding Operations-16

| Animal Type | Total Animals |
|---|---|
| Beef | 17,775 |
| Dairy | 240 |
| Swine | 36,772 |




Overview map of the Clarks Creek watershed. Land use from the 2001 National Land Cover Dataset.

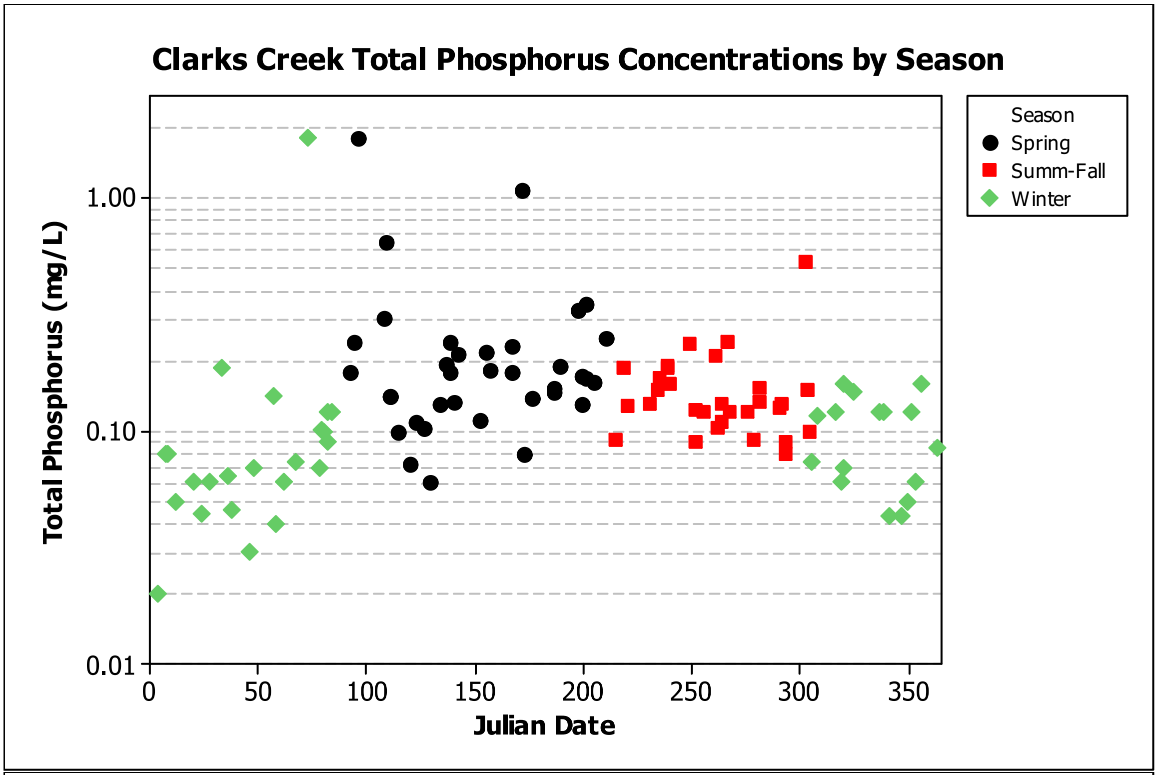
**Stream Chemistry-**

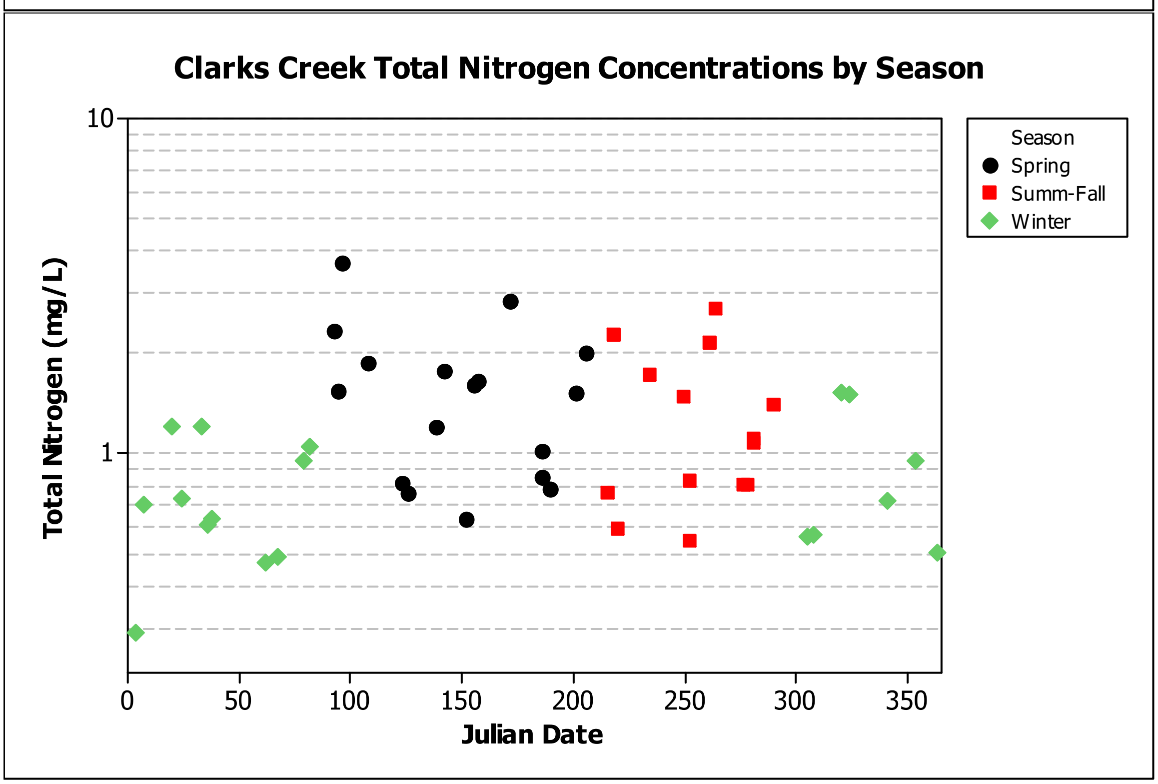
Clarks Creek has a moderate ranking for TSS when compared to other stations in these hydrologic units, a moderately good ranking for *E. coli*, and very poor ranking for total phosphorus and total nitrogen. Clarks Creek experiences its highest pollutant concentrations during the spring season (April-July) some reductions during the summer/fall (August- October), and the lowest concentrations during the winter (November-March). While Clarks Creek does not have an active gaging station, these results are consistent with similar results in other gaged watersheds for areas experiencing runoff and high flow event contamination for sediment, phosphorus and organic nitrogen. Inorganic nitrogen shows no seasonal behavior, with high concentrations occurring throughout the year, suggesting a groundwater input that consistently leaches nitrogen into these streams.

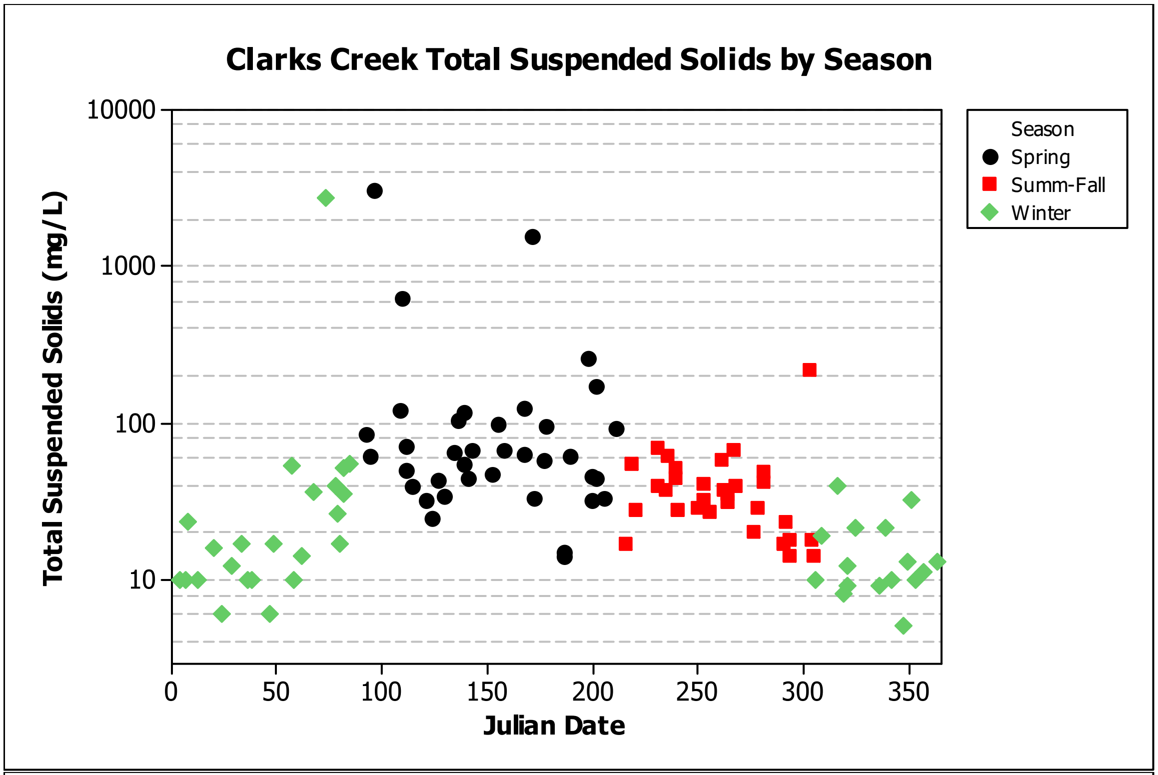
The strong seasonal nature of most of the contaminants suggests that measures targeting soil erosion, including stream bank stabilization, and buffering of streams from cropland will have significant beneficial impacts. Strategies for reducing livestock interaction with streams will likely have positive impacts on the observed bacteria levels. Long-term reductions in dissolved inorganic nitrogen levels may be produced by increased riparian buffering with forest. Once trees develop deep root systems that intercept groundwater flows reductions in inorganic nitrogen loads can be expected. Long-term reductions may occur with increased use of soil testing to ensure that fertilizer application rates do not exceed crop needs.

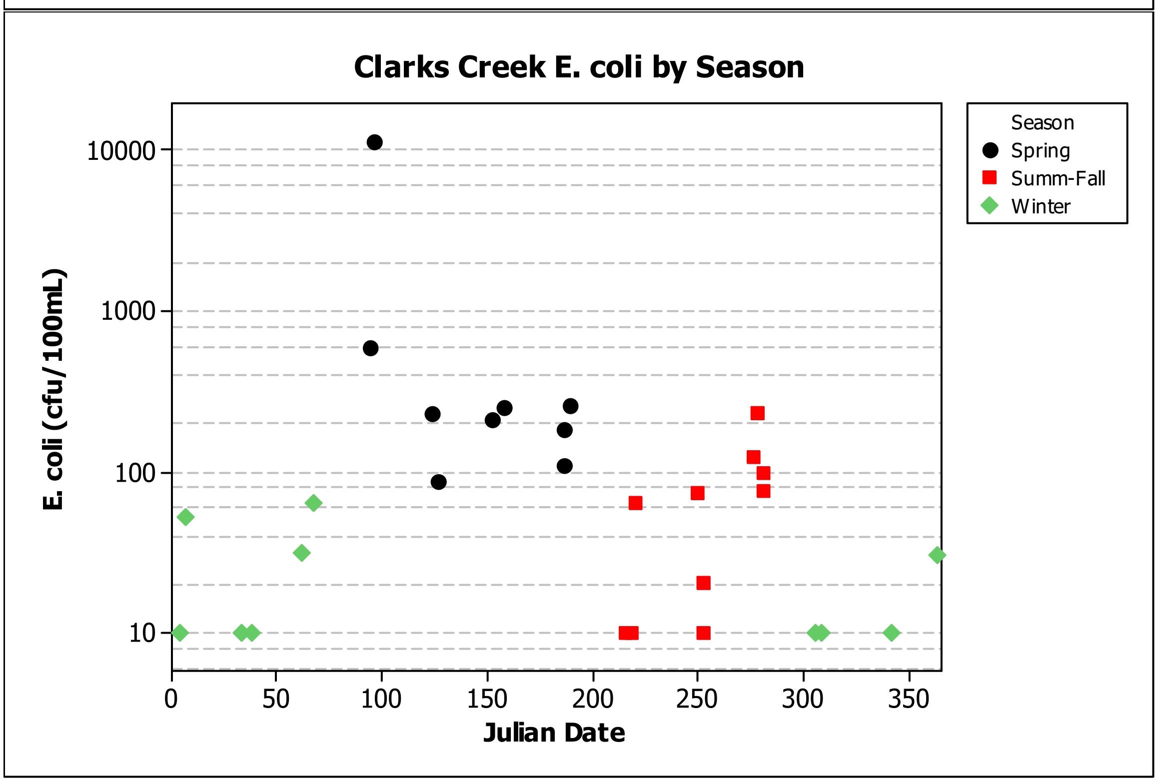
| | TP Median | TSS Median | Turbidity Median | TOC Median | Kjeldahl Median | *E.coli* Median | TN Median |
|---|---|---|---|---|---|---|---|
| Overall | 0.1265 (106) | 34 (107) | 13 (107) | 3.776 (42) | 0.53 (49) | 63 (29) | 1.01 (49) |
| Spring | 0.176 (36) | 62 (37) | 27 (37) | 5.688 (15) | 0.825 (17) | 231 (9) | 1.529 (17) |
| Summer Fall | 0.13 (31) | 35 (31) | 13 (31) | 3.105 (13) | 0.569 (14) | 68 (10) | 1.091 (14) |
| Winter | 0.074 (39) | 13 (39) | 5.85 (39) | 3.3565 (14) | 0.3715 (18) | ≤10 (10) | 0.7105 (18) |

Numbers in parenthesis indicate sample size.


Clarks Creek Total Phosphorus Concentrations by Season
Total Phosphorus (mg/L)
1.00
0.10
0.01
0
50
100
150
200
250
300
350
Julian Date
Season
Spring
Summ-Fall
Winter

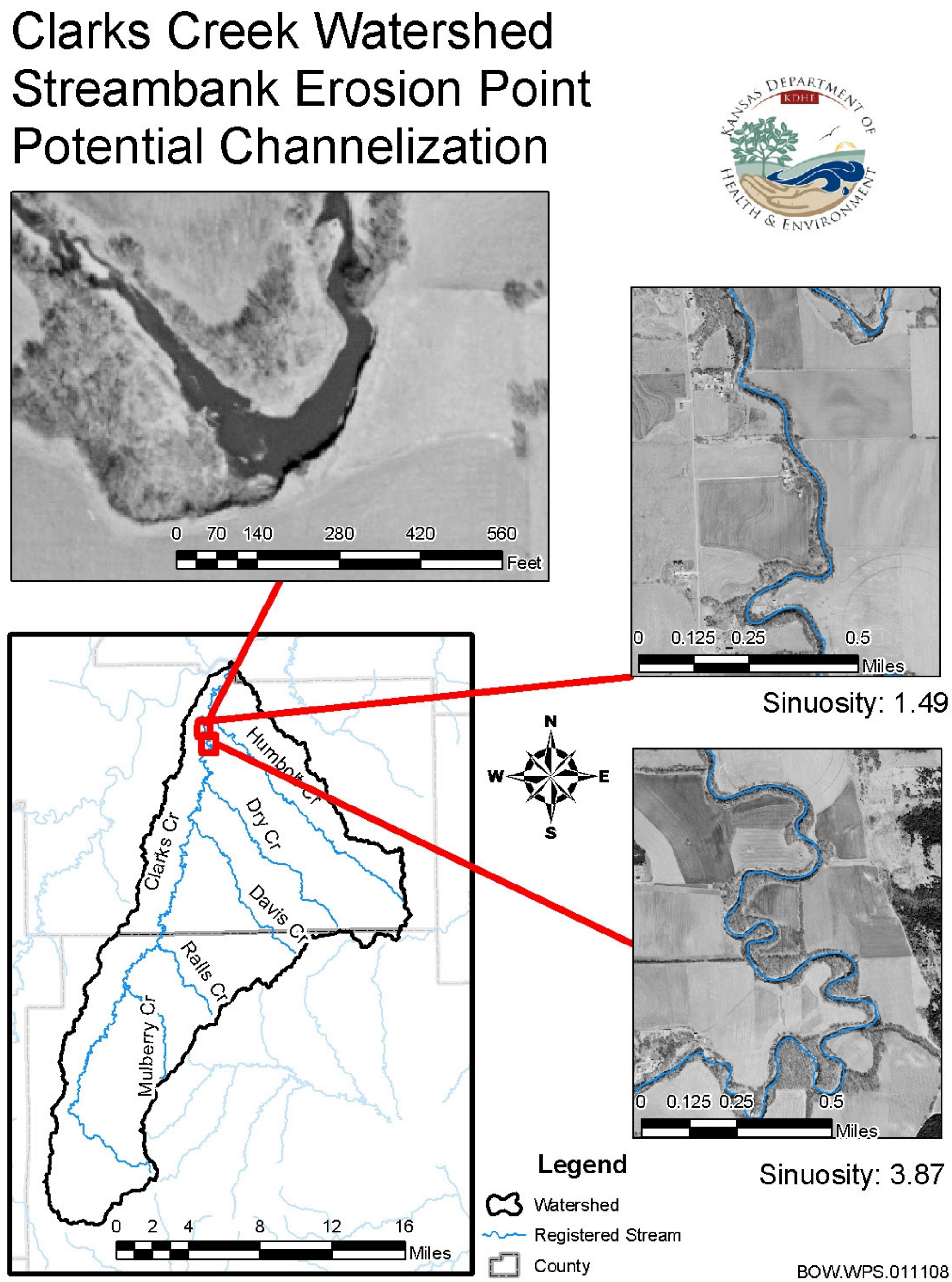

Clarks Creek Total Nitrogen Concentrations by Season
Total Ntrogen (mg/L)
10
1
0
50
100
150
200
250
300
350
Julian Date
Season
Spring
Summ-Fall
Winter




Streambank stabilization may play an important role in improving water quality in the Clarks Creek watershed. One meter resolution aerial photographs were used to identify a number of potential unstable streambanks in the lower reaches of the watershed.

Inspection of stream channel sinuosity also suggests that channelization has occurred, and may be contributing to the observed water quality.




**Uncertainty-**

Because no gage data are available concurrently with the stream chemistry data, some uncertainty exists about the flow conditions associated with the samples. Very large

TSS values likely occurred during very high flow events, which may be less responsive to restoration efforts (Meals, 1990). Previous research (unpublished) by KDHE has indicated that median values are strong descriptors of nutrient related impairments, even in the absence of flow data, when large sample records exist. At this level of analysis it is not possible to determine the relative contributions of overland flow and in-stream processes, including collapsing streambanks. Elevated nitrogen levels could also be indicative of failing on-site wastewater systems, which cannot be ruled out as a potential contributor at this level of analysis. Future restoration efforts in this area would benefit from more water quality data throughout the watershed, to pinpoint potential sources of pollution, and better define the spatial and temporal variation in water quality. Additionally, surveys of stream channel morphology will locate potential sources of major bank instability.

**Adaptive Implementation Strategies-**

Because this stream exhibits characteristics that are consistent with both overland flow and unstable streambank sources near the KDHE monitoring station, initial efforts could be focused on the lower reaches of Clarks Creek and Humboldt Creek. These areas epitomize the use of alluvial valleys for row crop production, and show significant signs of poor buffering around the streams. While a bacteria TMDL exists for this watershed, the TMDL was developed under the previous water quality criteria, which dealt with fecal coliform bacteria. The current *E. coli* data show relatively good conditions at the monitoring station, though improvements could be made. Provisions for alternate watering sites, livestock exclusion from streams and ponds, and other efforts to separate the cattle from the streams could prove beneficial to reducing sediment, nutrient and pathogen loading to the streams. Manure management plans for the confined animal operations may also have benefits, depending on their proximity to the stream system.

Because riparian buffering activities typically take three or more years to fully establish themselves, monitoring of post-implementation water quality should be a long-term objective. The existing monitoring record is unlikely to have many high-flow events, due to the design of the sampling program. Because the majority of loads of suspended solids and total phosphorus are likely to occur during a few, relatively large events, a before-and after- sampling program focused on high flow events would determine if efforts lead to significant improvements to water quality. For dissolved inorganic nitrogen, a significant time lag can occur due to elevated groundwater concentrations, which can take many years to reduce. If nitrogen is a priority issue, a groundwater sampling program may be needed to identify critical areas of elevated nitrogen. A less expensive strategy would be to increase the use of soil sampling to target fertilizer delivery to fields at rates unlikely to leach into the groundwater.

It should be noted that some strategies to reduce nutrient pollution have confounding effects. Tillage and cover strategies that reduce runoff and increase infiltration have been documented in some cases to increase nitrogen infiltration to groundwater. Increased infiltration should reduce phosphorus and sediment loading, and riparian planting of forest areas are likely to reduce groundwater loading of nitrogen to the stream, while increasing bank stability. Therefore, implementing strategies should target field runoff for sediment and phosphorus loading, and simultaneously implement riparian restoration.

Should streambank stabilization, riparian planting, and other buffering activities in the lower reaches not reduce sediment and nutrient loading to acceptable levels, targeted monitoring may be required to determine sources more accurately. Funding for practices to improve water quality should focus on lands adjacent to streams in HUC 102701010101, which are more likely to contribute to water quality problems monitored at station 517.